KENWOOD®

SERVICE MANUAL

Model TR-7850

VHF FM TRANSCEIVER

A product of
TRIO-KENWOOD CORPORATION
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USE THIS SERVICE MANUAL
TOGETHER WITH THAT OF TR-7800.

CONTENTS

SPECIFICATIONS

[General]

Semiconductors	MPU 1 ICs 18 (W)(T), 19 (K)(M) Transistors 58 (W)(T), 60 (K)(M) FETs 9 Diodes 79 (K)(M)(T), 78 (W)
Frequency range	144.000 to 145.995 MHz (W)(T) 144.000 to 148.995 MHz (K)(M)
Frequency synthesizer	Digital control, phase locked VCO
Mode	FM (F3)
Antenna impedance	50 ohms
Power requirement	13.8V DC ±15%
Grounding	Negative
Operating temperature	−20°C to +50°C
Current drain	0.4A in receive mode with no input signal 9A in HI transmit mode (Approx.) Less than 3 mA for memory back up (from an external power supply through the BACK UP terminal) Less than 2 mA for memory back up (from battery)
Dimensions	175 mm (6-7/8") wide 64 mm (2-1/2") high 220 mm (8-5/8") deep (projections excluded)
Weight	2.2 kg (4.84 lbs) (approx.)

[Transmitter Section]

RF output power (at 13.8V DC, 50Ω load)	HI 40 Watts min. LOW 1 to 15 watts approx. (According to FREQ.)
Modulation	Variable reactance direct shift
Frequency tolerance (−20°C ~ +50°C)	Less than $\pm 20 \times 10^{-6}$
Spurious radiation	HI Less than −60 dB LOW Less than −53 dB
Maximum frequency deviation (FM)	±5 kHz
RPT. Tone burst frequency	1,750 Hz
Microphone	Dynamic microphone with PTT switch, 500Ω

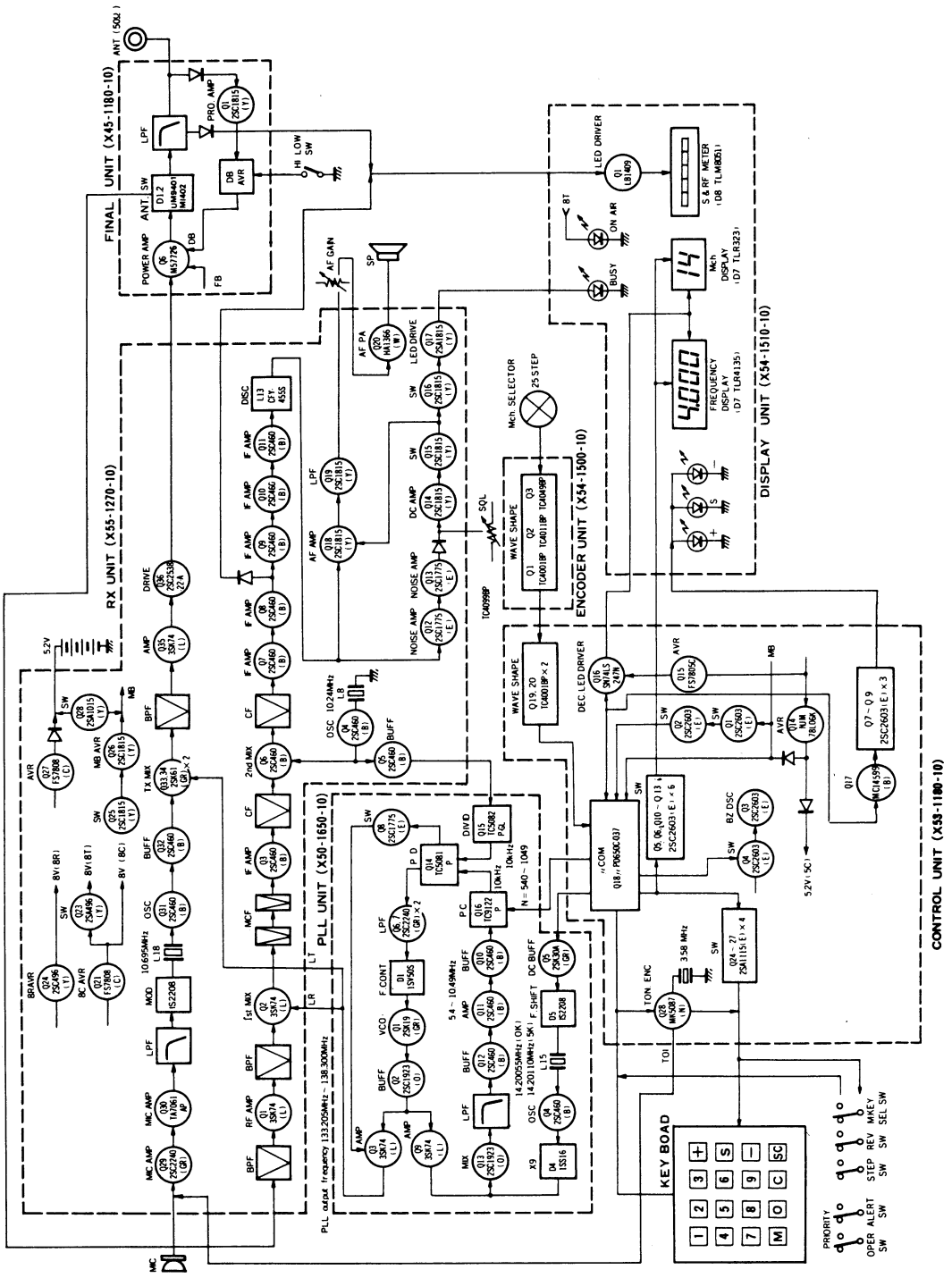
[Receiver Section]

Circuitry	Double conversion superheterodyne
Intermediate frequency	1st IF 10.695 MHz 2nd IF 455 kHz
Receiver sensitivity	Better than 0.5 μV for 30 dB S/N Better than 0.2 μV for 12 dB SINAD
Receiver selectivity	More than 12 kHz (−6 dB) Less than 24 kHz (−60 dB)
Spurious response	Better than 60 dB
Squelch sensitivity	0.16 μV (threshold)
Auto scan stop level	Less than 0.2 μV (threshold)
Audio output	More than 2.0 watts across 8 ohm load (10% dist.)

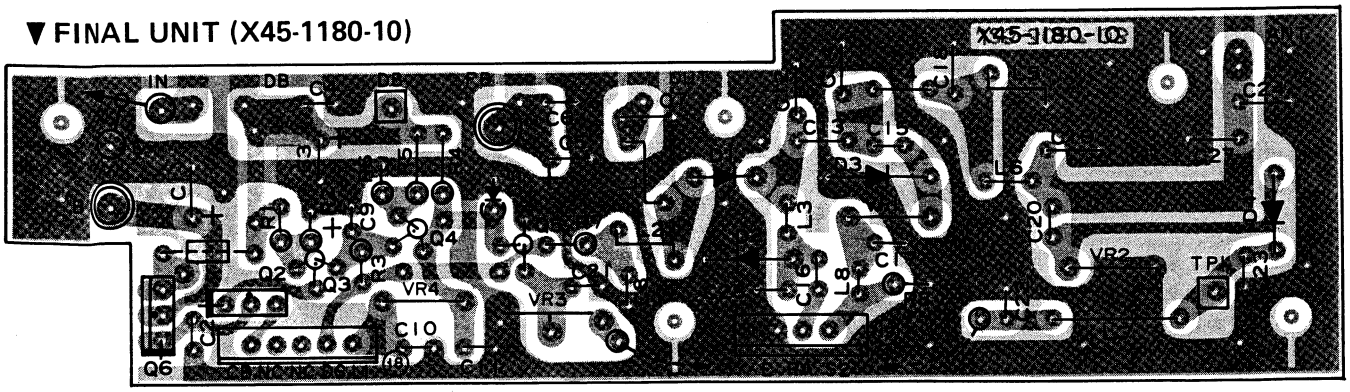
Note: Circuit and ratings are subject to change without notice due to developments in technology.

B51-0936-00 (K)(M)(W)(T) 1000 G

BLOCK DIAGRAM (K) / PC BOARD VIEW



▼ FINAL UNIT (X45-1180-10)



Q1: M57726 Q2: 2SA496 (Y) Q3～5: 2SC1815 (Y) Q6: 2SD880 (Y)
D1: UM9401 D2: MI402 D3: 1N60 D4: 1SS99 D5: XZ-064 D6: U15B

PARTS LIST

Note 1: Destination
(K): U.S.A
(T): Britain
(W): Europe
(M): General market

Note 2: Abbreviation

Abbreviation		Abbreviation	
Cap.	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

GENERAL

☆: New Parts

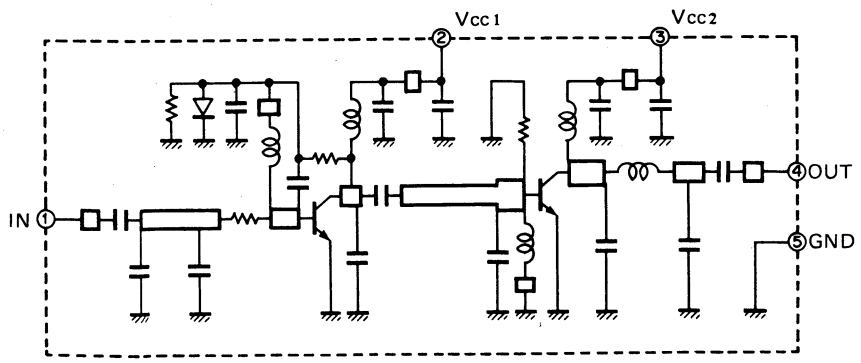
Ref. No.	Parts No.	Description	Re-marks
	A01-0772-03	Case (A) Upper	
	A01-0773-03	Case (B) Lower	
	A13-0612-02	Angle ass'y (right)	
	A13-0613-02	Angle ass'y (left)	
	A13-0614-04	Angle (top)	
	A13-0625-04	Angle ass'y	
	A20-2426-03	Panel (K)(M)	☆
	A20-2427-03	Panel (W)	☆
	A20-2428-03	Panel (T)	☆
	B03-0516-04	Switch mask × 2	☆
	B05-0701-04	Speaker grill cloth	
	B05-0713-04	Grill cloth (Tone oscillator)	
	B07-0625-04	Side escutcheon × 2	
	B07-0626-03	Front escutcheon	
	B10-0628-14	Front glass	
	B42-1685-04	Switch plate (H/L)	
	B46-0058-10	Warranty card (K)	
	B50-3901-00	Operating manual (K)(M)	☆
	B50-3902-00	Operating manual (W)	☆
	B50-3903-00	Operating manual (T)	☆
	E06-0651-05	6P Metal socket (MIC)	
	E07-0252-05	2P Metal socket (DC cord ass'y)	
	E07-0651-05	6P plug (MIC)	
	E12-0001-05	Earphone plug	
	E29-0412-05	1P Connector (male) × 2	
	E29-0413-05	1P Connector (female) × 2	
	E30-1685-05	DC cord ass'y	☆
	E31-0456-05	Plug with lead (SP)	
	F05-1031-05	Fuse (10A)	
	G02-0505-05	Knob spring (AF)	
	G09-0411-05	Knob spring (SQL)	
	G13-0643-04	Cushion (battery) 96 × 25 × 10.5 mm	☆
	G53-0511-04	Packing × 8 (case)	
	H01-2750-03	Carton case (inside) (k)(W)(M)	☆
	H01-2751-03	Carton case (inside) (T)	☆
	H10-2501-03	Styrene foam cushion (upper)	
	H10-2534-12	Styrene foam cushion (lower)	
	H25-0049-03	Accessory bag	
	H25-0079-04	Protective bag (MIC)	
	H25-0103-04	Protective bag (cord)	
	H25-0106-04	Protective bag	
	J02-0069-05	Foot × 2 (small, Rear)	
	J02-0070-05	Foot × 2 (large, Front)	
	J19-1334-05	Battery case	
	J21-0392-04	Lead holder	
	J21-2504-04	Speaker mounting plate	
	J31-0514-04	Spacer collar H/L	
	J32-0745-04	Round boss × 5	
	J32-0746-04	Hex. boss	
	J42-0409-04	Knob bush H/L	
	J61-0019-05	Vinyle tie × 2	
	K21-0751-03	Main knob	
	K23-0734-04	Knob (AF)	
	K23-0735-04	Knob (SQL)	
	K27-0414-04	Push knob × 5 (Square)	
	K27-0415-04	Push knob (KEY, M. SEL)	
	K29-0734-04	Push knob HI/LOW	
	N09-0008-04	Screw × 4 (angle)	
	N09-0256-05	Ground screw × 3	
	N09-0619-05	Plastic screw × 2 (battery)	☆
	N14-0508-04	Spanner nut	
	N14-0510-04	Flange nut × 4 (angle)	
	N14-0516-05	Speed nut × 2	
	N15-1040-46	Flat washer × 4 (angle)	
	N15-1060-41	Flat washer × 4 (angle)	
	N16-0060-41	Spring washer × 4 (angle)	
	N30-2604-46	Round screw × 31	
	N30-3006-46	Screw × 2	
	N30-3008-45	Screw × 2	
	N32-2606-45	Flat screw × 5	
	N32-3006-45	Flat screw × 12	
	N33-3006-45	Round flat screw (case, etc.)	
	N99-0304-04	Allen head bolt × 4 (angle)	
	R19-9404-05	Pot. 50kΩ (B), 10kΩ (K)	
	S40-2403-05	Push switch H/L	
	S40-2415-05	Push switch (K, T, M) × 5, (W) × 4	☆
	S40-2416-05	Push switch (K, T, M) × 1, (W) × 2	☆
	S50-1406-05	Tact switch	
	S59-0406-05	Key board ass'y	
	T03-0027-15	Speaker	
	T91-0311-05	Microphone (TRIO) (T)	
	T91-0313-05	Microphone (KENWOOD) (K) (W) (M)	
	V30-1170-05	LED AA5532T	
D101,102	W01-0401-04	Allen key	
	W02-0315-05	Rotary encoder	
	X45-1180-10	Final unit	☆
	X50-1650-10	PLL unit	
	X53-1180-10	Control unit (K) (M)	
	X53-1180-61	Control unit (W) (T)	
	X54-1500-10	Encoder unit	
	X54-1510-10	Display unit	
	X55-1270-10	RX unit (K) (M)	
	X55-1270-51	RX unit (T)	
	X55-1270-61	RX unit (W)	

PARTS LIST/SEMICONDUCTOR DATA

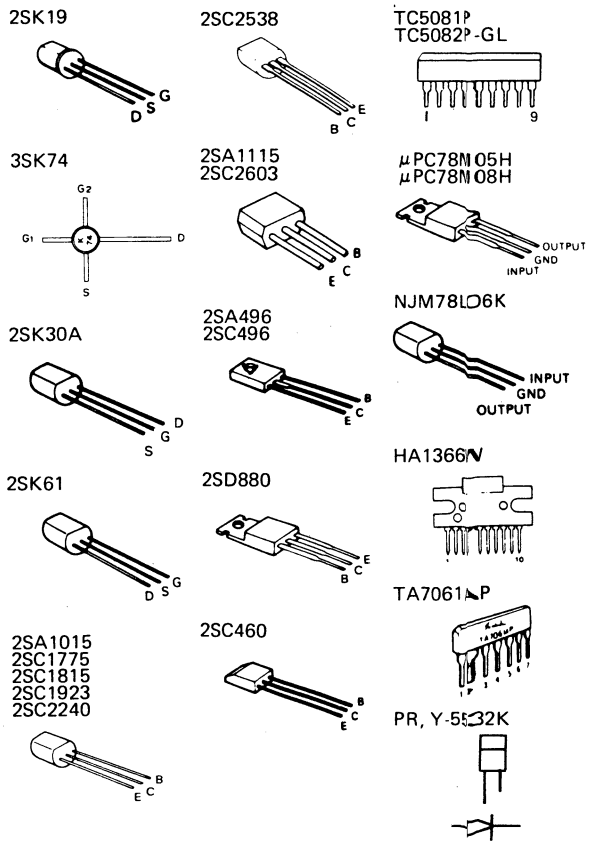
FINAL UNIT (X45-1180-10)

Ref. No.	Parts No.	Description	Remarks
C1	C90-0820-05	E 470μF 16V	
C2	CK45B1H102K	C 0.001μF	
C3	CE04W1C101M	E 100μF 16V	
C4	CK45B1H102K	C 0.001μF	
C5	CE04W1C101M	E 100μF 16V	
C6	CK45B1H102K	C 0.001μF	
C7	CC45SL2H050C	C 5pF ±0.25pF 500V	
C8	CK45B1H102K	C 0.001μF	
C9	CS15E1VR47M	T 0.47μF 35V	
C10,11	CK45B1H102K	C 0.001μF	
C12	CC45SL2H150J	C 15pF 500V	
C13	CK45E2H102P	C 0.001μF 500V	
C14	CC45SL2H150J	C 15pF 500V	
C15	CC45CH1H010C	C 1pF ±0.25pF	
C16	CC45SL1H101J	C 100pF	
C17	CK45B1H102K	C 0.001μF	
C18	CC45SL2H390J	C 39pF 500V	
C19	CC45SL2H100D	C 10pF ±0.5pF 500V	
C20	CC45CH1H010C	C 1pF ±0.25pF	
C21～23	CK45B1H102K	C 0.001μF	
C24	CC45SL2H220J	C 22pF 500V	
C25	CC45SL2H150J	C 15pF 500V	
C26	CK45B1H102K	C 0.001μF	
C27	CC45SL2H020C	C 2pF ±0.25pF 500V	
C28	CC45CH1H070D	C 7pF ±0.5pF	
	E04-0152-05	UHF type receptacle	
	E06-0252-05	2P metal socket (Power)	
	E08-0304-05	Power jack Back up	
	E11-0403-05	Earphone jack	
	E23-0046-04	Square terminal	
	E23-0401-05	Round terminal	

Ref. No.	Parts No.	Description	Remarks
	F01-0758-05	Heat sink	☆
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
L1	L34-1020-05	Coil φ3 3.5T	☆
L2	L34-0908-05	Coil φ3	
L3	L34-0692-05	VHF coil φ5 4T	
L4	L34-0742-05	Coil φ3 5T	
L5	L34-0908-05	Coil φ3	
L6	L34-0499-05	VHF coil φ3 4T	
L7	L33-0026-05	Choke coil 1μH	
L8	L40-1511-03	Ferri-inductor 150μH	
L9	L34-0822-05	VHF coil φ5 3T	
R7	RC05GF2H151J	Solid 150Ω 1/2W	
VR1	R12-4020-05	Trim. pot 50kΩ (2 poles)	
VR2	R12-0417-05	Trim. pot 100Ω (2 poles)	
VR3	R12-4016-05	Trim. pot 50kΩ (2 poles)	
VR4	R12-0053-05	Trim. pot 500Ω (2 poles)	
	R92-0150-05	Short jumper	
Q1	V30-1239-56	Power module M57726	☆
Q2	V01-0113-05	TR 2SA496 (Y)	
Q3～5	V03-1815-06	TR 2SC1815 (Y)	
Q6	V04-0880-16	TR 2SD880 (Y)	
D1	V11-7778-16	Diode UM9401	☆
D2	V11-5260-16	Diode MI402	
D3	V11-0051-05	Diode 1N60	
D4	V11-1277-86	Diode 1SS99	
D5	V11-4104-20	Zener diode XZ064	
D6	V11-6460-26	Diode U15B	



Power Module M57726 Equivalent Circuit



MAX Rating M57726

Item	Symbol	Tc (°C)	Rating
Operating voltage	Vcc	25	17V
DC current	Icc	25	14A
Operating case temp.	Tc (op)		−30 ～ + 110°C
Storage temp.	Tstg		−40 ～ + 110°C

Electrical characteristic M57726

Item	Symbol	Tc (°C)	Condition	Value Min.	Value Typ.
Power output	P_o	25	Vcc = 12.5V, F = 144 ～ 148 MHz, PIN = 0.4W, ZL = ZG = 50Ω	43W	47W
Total efficiency	η_T	25	Vcc = 12.5V, F = 144 ～ 148 MHz, PIN = 0.4W, ZL = ZG = 50Ω	50%	54%

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications	Remarks
		Test equipment	Unit	Ter-minal	Unit	Part	Method		
1. Drive check	1) Remove the coaxial cable connected to terminal DO of the RX unit. Connect a power meter of F.S. = 3W to terminal DO f=148.00 MHz (K) f=145.995 MHz (W, T) Transmit	Power meter 3W			RX	TC2, 3	Adjust TC2 and TC3 for maximum output.	0.4~0.5W	
2. Power check	1) Center VR1, VR2 and VR4 of the final unit and turn VR3 all the way to the left. f=147.00 MHz (K) f=145.995 MHz (W, T) Connect the coaxial cable to terminal DO. Transmit	DC V.M	Final	TP1	Final	VR2	Adjust VR2 for the minimum voltage reading.	0.7V or less	
	2) Adjust the frequency to each of the following frequencies f=144.00 MHz, 146.00 MHz, 148.00 MHz (K) f=144.00 MHz, 145.995 MHz (W, T)	Power meter, DC A.M.						42W or more, 9.0A or less	Check
	3) K type only f= 148.995 MHz	Power meter						38W or more	
3. LOW power and LED meter	1) HI/LOW switch: LOW f=148.00 MHz (K) f=145.995 MHz (W, T)	Power meter			Final	VR4	Adjust VR4 for a power meter reading of 16W.		
	2) f=148.995 MHz (K) f=145.995 MHz (W, T)				Final	VR1	Adjust VR1 so that the fifth digit of the LED meter just goes off.		
	3) f=148.000 MHz (K) f=145.995 MHz (W, T)				Final	VR4	Adjust VR4 so that the power meter reads 14W (K) or 10W (W, T).		
	4) HI/LOW switch: HI.							All digits of the LED meter light.	Check
	5) HI/LOW switch: LOW f=144.000 MHz							1W or more	
4. Output power at a power supply voltage of 11V	1) Power supply votage: 11.0V HI/LOW switch: HI.	Power meter						20W or more	Check
	2) HI/LOW switch: LOW							The power meter moves to some extent.	
5. Protection	1) ANT terminal: Open Power supply voltage: 13.8V HI/LOW switch: HI f=148.000 MHz (K) f=145.995 MHz (W, T)	DC A.M.	Final	TP2	Final	VR3	Turn VR3 clockwise until the DC ammeter reads 4A.		
	2) f=143.900~148.995 MHz (K) f=144.000~145.995 MHz (W, T)							5A or less	Check
	3) Connect the power meter to the ANT terminal.	Power meter						42W or more	

SCHEMATIC ABBREVIATION

PLL UNIT (X50-1650-10)

Wire harness number	Terminal	Remarks
⑯	CV	Control voltage for Vari-caps
	5V	+5 Volts
	RO	Reference oscillator 10.240 MHz
⑭	11	A
	12	B
	13	C
	14	D
	21	A
	22	B
	23	C
⑮	24	D
	31	A
	32	B
	33	C
	34	D
	35	10 MHz PLL Data
⑬	8C	+8 Common
	5K	5 kHz from CPU to turn on Q-5

CONTROL UNIT (X53-1180-10)

⑧	MB	+5.2 Memory back up voltage
	5C	+5 Common
	CB	+13.8 Common
⑨	See PLL	
⑩	See PLL	
⑪	TO	Tone out
	8T	+8 on TX
	SS	Scan stop from Q17 Low to high when Squelch open
	DO	Down signal from mic sw. Hi to low when sw push
	UP	Up signal from mic sw. Hi to low when sw push
㉑	A	Rotary encoder information to CPU
	B	
	C	
	D	
	5C	+5 Common
⑫	PS	When priority/operate on
	PC	Priority operation input
	KY	When MEM/Sel on
	RV	When REV on
	ST	When Step 5 kHz/10 kHz on
	C2	Common pulse output
	C3	Common reverse pulse output
	RM	Minus offset Hi when + offset
	RP	Plus offset Hi when − offset
	S	Simplex Hi when in simplex
	C2	
	C3	
	F1～F4	Main digit display drive signals
	5D	+5 for display from Q-15
	a～f	Segment drive signals

RX UNIT (X55-1270-10)

①	MC	Mic input
	TT	Touch tone signal from control unit
	MB	Memory back up +5.2
	BT	Battery terminal back up batteries
	BB	External battery back up
	B	Common +13.8
	CGB	Always +13.8
②	CB	+13.8
	B	+13.8
	DS	Diode switch +8 when TX
	ST	Ptt switch signal +8 to 0 when PTT ON
	NC	open
	A1	Top of AF VR control
③	8T	+8 in TX
	SQ	Arm of squelch VR
	BD	To LED Busy Light
	SS	Scan stop +5 when squelch open
	TL	Transmit light
	S2	RF level from final unit for meter
	8C	+8 common from Q-21
	S1	S meter level signal to display
	RB	0 in TX +8.8 in RX
	8R	+8 in RX
④	LR	PLL signal local reference
⑤	SP	Speaker to external speaker
	RO	Reference oscillator 10.240 MHz
	CV	Control voltage for Varicaps
	A2	Arm of AF VR
	8T	+8 in TX
	AP	Audio output
⑥	RA	Receive antenna
⑦	LT	PLL drive for TX
	DO	Drive out to final
	SP	To internal speaker
	DB	Drive B+ 12.3 on TX

DISPLAY UNIT (X54-1510-10)

⑳	TL	Transmit light
	BD	Busy light
	S1	Smeter/power meter signal

FINAL UNIT (X45-1150-10)

	B	+13.8 when power switch on
	IN	Drive from RX unit
	DB	+12.3 for Hi power TX
	FB	B+ for hi power
	OUT	RF out
	ANT	Antenna terminal
⑱	CB	Common 13.8
	DS	+8 when TX diode sw line for UM 9401, MI 402
	L1	Ground in low power
⑲	RA	Receive antenna
	S2	RF level signal

SCHEMATIC DIAGRAM (K)(M)

PLL UNIT (X50-1650-10)

Q1	: 2SK19 (GR)	D1	: 1SV505
Q2,13	: 2SC1923 (O)	D2,3	: 1S2588
Q3,9	: 3SK74 (L)	D4	: 1SS16
Q4,10~12	: 2SC460 (B)	D5	: 1S2208
Q5	: 2SK30A (GR)		
Q6,7	: 2SC2240 (GR)		
Q8	: 2SC1775 (E)		
Q14	: TC5081P		
Q15	: TC5082P-GL		
Q16	: TC9122P		

Q1,2,35	: 3SK74 (L)	Q29	: 2SC2240 (GR)
Q3~11,31,32	: 2SC460 (B)	Q30	: TA7061AP
Q12,13	: 2SC1775 (E)	Q33,34	: 2SK61 (GR)
Q14~16,18,19,25,26	: 2SC1815 (Y)	Q36	: 2SC2538-22-A
Q17,28	: 2SA1015 (Y)		
Q20	: HA1366W		
Q21,27	: μPC78M08H		
Q23	: 2SA496 (Y)		
Q24	: 2SC496 (Y)		

D1,2,7~10	: 1N60
D3~6,12,14,16,25	: 1S1555
D11	: 1S1212
D15	: XZ-088
D17	: XZ-060
D18	: XZ-070
D19	: V06B
D20,21	: 1S2208
D13,22~24	: 1TT410

RX UNIT (X55-1270-10)

CONTROL UNIT (X55-1180-10)

Q1~13,21~23	: 2SC2603 (E)
Q14	: NJM78L06K
Q15	: μPC78M05H
Q16	: SN74LS247N
Q17	: MC145998
Q18	: μPD650C-037
Q19,20	: TC4001BP
Q24~27	: 2SA1115 (E)
Q28	: MK5087N
D1	: XZ-060
D2~11,13~17,19~24, 31,32	: 1S1555
D12,25,26	: 1N60

FINAL UNIT (X45-1180-10)

Q1	: M57726
Q2	: 2SA496 (Y)
Q3~5	: 2SC1815 (Y)
Q6	: 2SD880 (Y)
D1	: UM9401
D2	: MI402
D3	: 1N60
D4	: 1S599
D5	: XZ-064
D6	: U15B

ENCODER UNIT (X54-1500-10)

Q1,2	: TC4001BP
Q3	: TC4049BP

DISPLAY UNIT (X54-1510-10)

Q1	: LB1409
D1,3,5	: PR5532K
D2,4	: PY5532K
D6	: TLR4135
D7	: TLR323
D8	: TLM8051

Voltage measure condition
f=146.0 MHz
( ): in TX

Signal ---------- Control ——— Common DC line

SCHEMATIC DIAGRAM (W)(T)

PLL UNIT (X50-1650-10)

CONTROL UNIT (X53-1180-61)

RX UNIT (X55-1270-51,-61)

FINAL UNIT (X45-1180-10)

ENCODER UNIT (X54-1500-10)

DISPLAY UNIT (X54-1510-10)

KEY BOARD

1	2	3	+
4	5	6	S
7	8	9	-
✱ M	0	# LOW	SC

Q1 : 2SK19(GR)
Q2,13 : 2SC1923(O)
Q3,9 : 3SK74(L)
Q4,10~12 : 2SC4601(B)
Q5 : 2SK30A(GR)
Q6,7 : 2SC2240(GR)
Q8 : 2SC1775(E)
Q14 : TC5081P
Q15 : TC5082P-GL
Q16 : TC9122P

D1 : 1SV505
D2,3 : 1S2588
D4 : 1SS16
D5 : 1S2208

Q1,2,35 : 3SK74(L)
Q3~11,31,32 : 2SC4601(B)
Q12,13 : 2SC1775(E)
Q14~16,18,19,25,26 : 2SC1815(Y)
Q17,28 : 2SA1015(Y)
Q20 : HA1366W
Q21,27 : μPC78M08H
Q23 : 2SA496(Y)
Q24 : 2SC496(Y)

Q29 : 2SC2240(GR)
Q30 : TA7061AP
Q33,34 : 2SK61(GR)
Q36 : 2SC2538-22-A
Q37,38 : 2SC458(B)

D1,2,7~10 : 1N60
D3~6,12,14,16,25~27 : 1S1555
D11 : 1S1212
D15 : XZ-088
D17 : XZ-060
D18 : XZ-070
D19 : V06B
D20,21 : 1S2208
D13,22~24 : 1TT410

Q1~13,21~23 : 2SC2603(E)
Q14 : NJM78L06K
Q15 : μPC78M05H
Q16 : SN74LS247N
Q17 : MC14599B
Q18 : μPD650G-037
Q19,20 : TC4001BP

D1 : XZ-060
D2~11,13~17,19~24, 33~36 : 1S1555
D12,25,26 : 1N60

Q1,2 : TC4001BP
Q3 : TC4049BP

Q1 : LB1409

D1,3,5 : PR5532K
D2,4 : PY5532K
D6 : TLR4135
D7 : TLR323
D8 : TLM8051

Q1 : M57726
Q2 : 2SA496(Y)
Q3~5 : 2SC1815(Y)
Q6 : 2SD880(Y)

D1 : UM9401
D2 : MI402
D3 : 1N60
D4 : 1S599
D5 : XZ-064
D6 : U15B

TR-7850 (T,W)

Voltage measure condition
f=146.0 MHz
( ): inTX

Signal ------ Control ——— Common DC line